U. S. FOREST SERVICE

RESEARCH NOTE LS-50

KE STATES FOREST EXPERIMENT STATION • U. S. DEPARTMENT OF AGRICULTURE

A Cubic-Foot Volume Table for Unpeeled Pine Poles

Red and jack pine poles are important products from the forests of northern Minnesota. Considerable flexibility of thinning practices is made possible by the wide range of pole sizes presently used; these vary from 4 to 9 inches in top diameter and 10 to 45 feet in length. This range in sizes is troublesome, however, when numbers of poles must be converted to a single unit of measure as is sometimes necessary in cruising, appraising, and scaling timber. The cubic-foot volume table presented here provides a common unit of measure for a wide range of pole sizes.

To develop this table, the diameters of 190 red pine and 149 jack pine poles were measured at the butt end, at 10-foot intervals along the stem, and at the top. They were measured in the mill yard of the Wheeler Lumber Bridge and Supply Co. in Cass Lake, Minn., on five separate occasions, thus permitting a sample of poles cut by different operators and from a wide geographic area of northern Minnesota. The cubic-foot volume including bark was computed for each pole by Smalian's formula. A scatter diagram of cubic-foot volume plotted over the product of top diameter in inches (D) times total length (L) in feet (hereafter called DL) showed volumes curving upward with increasing values of DL. Also, variation increased in the larger sizes. Plotting the data on logarithmic paper resulted in a straight line with uniform variation for all values of DL. Therefore, the data were transformed to logarithms for the regression analysis.

A separate analysis for each species showed the two regression coefficients were not significantly different. Although the means of these two regressions were significantly different (at the 5-percent confidence level) the magnitude was less than 0.2 of a cubic foot. This difference scarcely justified separate volume tables for the two species. Therefore, they were combined to obtain the volume equation:

$$\text{logarithm } V = 1.4719\ (\text{logarithm DL}) - 2.2964$$

where V equals volume and DL equals the product of top diameter outside bark in inches times the length in feet. The standard error of estimate for the logarithm of volume is $\pm$ 0.05066, which is $\pm$ 12.4 percent in terms of cubic-foot volume.[1] Ninety-seven percent of the variation in volume among the poles sampled is accounted for by the formula.

Because of the nature of logarithms, the formula tends to under-estimate volumes, the magnitude depending on the standard error of the estimate.[2] The correction for this regression was computed to be 0.68 percent and has been added to the volumes in table 1.

Product specifications used in this study (table 2) could undoubtedly be modified somewhat without seriously affecting the vol-

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1 *This procedure underestimates the lower limits of error slightly. A more accurate value can be obtained by dividing the volume by 1.124 (the antilog of 0.05066).*

2 *Spurr, Stephen H. Forest inventory. 476 pp. Ronald Press Co., New York. 1952.*

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ume predictions, but major changes would probably require a new equation.

For some purposes it is desirable to convert the volume to equivalent cords. This conversion can be accomplished by dividing the cubic-foot volume of the poles (obtained by using the table or formula) by 92, which is the average number of cubic feet per cord of solid wood (79) plus bark (13).[3]

[3] *Gevorkiantz, S. R., and Olsen, L. P. Composite volume tables for timber and their application in the Lake States. U.S. Dept. Agr. Tech. Bul. 1104, 51 pp. 1955.*

TABLE 1. — *Cubic-foot volume (including bark) of unpeeled red and jack pine poles*

Length (feet)	Top diameter outside bark (inches)					
	4	5	6	7	8	9
10	1.1	1.6	2.1	2.6	3.2	3.8
12	1.5	2.1	2.7	3.4	4.2	5.0
14	1.9	2.6	3.4	4.3	5.2	6.2
16	2.3	3.2	4.2	5.2	6.4	7.6
18	2.7	3.8	5.2	6.2	7.6	9.1
20	3.2	4.4	5.8	7.3	9.0	10.7
22	3.7	5.1	6.7	8.5	10.3	12.2
25	4.4	6.2	8.2	10.2	12.4	14.8
30	5.8	8.2	10.6	13.3	16.2	19.3
35	7.3	10.2	13.3	16.7	20.3	24.2
40	9.0	12.4	16.2	20.3	24.8	29.5
45	10.6	14.7	19.3	24.2	29.5	35.0

TABLE 2. — *Product specifications used in this study*

Product	Length	Maximum crook or sweep[1]	Top diameter inside bark		Min. circumference over bark 6 feet from butt
			Min.	Max.	
	Feet	*Inches*	*Inches*	*Inches*	*Inches*
Building poles	10 and 12	1.0	5	7.5	None
Building poles	14 and 16	1.5	5	7.5	None
Building poles	18 and 22	2.0	5	7.5	None
Telephone poles	20 and 25	[2]	5	7.5	None
Telephone poles	30	[2]	5	7.5	29
Telephone poles	35	[2]	6	7.5	32
Telephone poles	40	[2]	7	8.5	36
Telephone poles	45	[2]	7	8.5	42

[1] *Deviation from centerline.*

[2] *Centerline shall not fall outside body of pole.*

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